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February 26, 2003

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APPLICATION NUMBER: ***60/346,277***
FILING DATE: ***January 09, 2002***
RELATED PCT APPLICATION NUMBER: *PCT/US03/00536*

By Authority of the
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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a **PROVISIONAL APPLICATION FOR PATENT** under 37 CFR 1.53(c).

INVENTOR(S)		
Given Name (first & middle[if any])	*Family Name or Surname*	*Residence (City & either State or Country)*
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TITLE OF THE INVENTION

A METHOD FOR HEATING THERMOPLASTIC MATERIALS INTERNALLY WITH THE OBJECT OF MELTING TWO THERMOPLASTIC SURFACES TOGETHER AND CONSEQUENTLY CAUSING THOSE SURFACES TO WELD EACH TO THE OTHER OR WITH THE OBJECT OF HEATING THE THERMOPLASTIC MATERIAL SUCH THAT IT RADIATES ENERGY

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ENCLOSED APPLICATION PARTS *(check all that apply)*

X	Specification-Number of Pages = 4		CD(s), Number
X	Drawing(s)-Number of Sheet(s) = 1		Other:
	Application Data Sheet		

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION

___ Applicant claims **small entity status.**

___ A check is enclosed to cover the filing fee for a LARGE ENTITY = **$ 160**
X A check is enclosed to cover the filing fee for a SMALL ENTITY = **$ 80**
X *The Commissioner is hereby authorized to charge any additional fees due in connection herewith or to credit any overpayment to Deposit Account No. 12-0555.*

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

X No.
Yes, name of U.S. Government agency and the Government contract number are:

Respectfully submitted,

Date: January 8, 2002

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A METHOD FOR HEATING THERMOPLASTIC MATERIALS INTERNALLY WITH THE OBJECT OF MELTING TWO THERMOPLASTIC SURFACES TOGETHER AND CONSEQUENTLY CAUSING THOSE SURFACES TO WELD EACH TO THE OTHER OR WITH THE OBJECT OF HEATING THE THERMOPLASTIC MATERIAL SUCH THAT IT RADIATES ENERGY.

Background of the invention

Joining two pieces or parts made of polymers is normally achieved using a variety of methods of introducing energy into the joint face. These methods include vibrating the two surfaces together, using ultra-sonic vibration to excite the material at the interface, using radio frequency electro-magnetic energy to cause the interface to be heated, heating the two surfaces independently and bringing the surfaces together in a molten state, adding heat energy at the outside surfaces such that it is conducted to the interface. All of these methods use complex machinery and are limited in their use.

The present invention

The present invention uses the conductive properties of carbon fibre to introduce thermal energy to a joint surface or to the interior of a thermoplastic by incorporating the carbon fibre into the joint and by applying a low voltage to the carbon material. The carbon is introduced into a joint in the form of a tape made up of carbon voile of approximate density of less than 10 grams per square meter. The joint is clamped together using mechanical pressure or by evacuating the joint itself relying on atmospheric pressure to apply pressure to the joint. A low voltage, typically less than 60 volts is applied, dependent on the length and width of the joint. The voltage applied is such as to cause a current of sufficient strength to be applied to raise the temperature within the joint to above the melt point of the plastic. At that point, the plastic flows through the fine interstices in the carbon voile and a structural joint is achieved.

The benefits of the method include simple equipment, the equipment being made up of a variable transformer capable of reducing mains voltage to the desired voltage and fitted with appropriate safety devices such as a timer and an earth leakage circuit breaker, low cost of the tape, very rapid welding being achieved typically in less than 10 seconds for a significant weld area and good structural integrity where the weld area is reinforced by the carbon fibre voile material.

A significant advantage of the present invention is that the molten thermoplastic is at all times protected from the atmosphere such that no oxidation takes place.

A further advantage is that the outside surfaces of the joint are in no way affected by the weld and therefore delicate materials and finishes can be welded without damage.

A further advantage is that the system can be used to weld materials containing reinforcing fibres where very high joint pressures can be applied to ensure that the joint retains the full strength of the parent materials. Because it is only the joint surfaces that are heated and since that heating is achieved rapidly and maintained only for a short period, very high pressures can be applied to ensure that the strongest possible joint is obtained.

The welding tape is made up of the carbon voile edged with a narrow conductive tape or band. The tape can also be furnished with adhesive properties so that the joint is held in place while the weld occurs.

Where a heated surface or a heated material is desired, the carbon voile can be incorporated into a sheet of thermoplastic by sandwiching the voile between two thin sheets and then compression moulding the resulting sandwich into a thicker homogenous sheet. In such instance, the voile is bounded on two opposite edges with a conductive wire or tape, the ends of which protrude beyond the periphery of the completed sheet. When a low voltage is applied to the material through the conductive tapes or wires, the surface temperature of the sheet is raised to the desired level and maintained at that level such that the sheet acts as a radiator. The invention can be used as a wall radiator, for heated floors or ceilings, to make heated tanks or containers and in other applications.

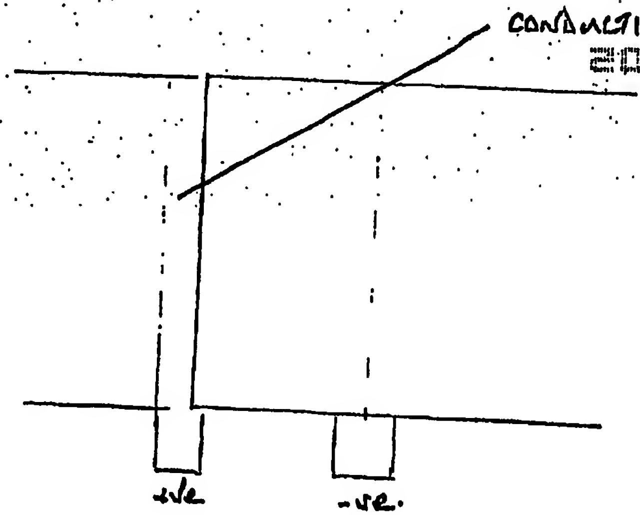
The present invention can be utilised to bend large sheets of thermoplastic by incorporating a thinner tape of a width equal to approximately ten times the thickness of the sheet.

Where a low voltage is applied to the tape in a similar manner to that described previously, the material can be heated and as a result easily formed into a bend of the desired angle and radius.

The welding tape can also be used to heat pipes, valves and similar fittings to prevent the contents of the pipes freezing or become viscid. In this application of the present invention the tape is wrapped around the pipe in lengths of not more than 120 inches, care being taken to leave a gap between each wrapping of the tape around the pipe. The outside surface is then wrapped with a thermoplastic or fabric tape, capable of withstanding the operating temperature and a low voltage applied to the carbon tape end to end to raise and maintain the temperature of the pipe or fitting.

Additional Embodiment - Use in Earth Box®

Additional applications are for the heating an Earth Box® (such as disclosed in U.S. Trademark Registration No. 1,906,561, and in U.S. Patents 5,555,675; 5,524,387; 5,379,547; 5,193,306 and 5,103,584, incorporated herein by reference) by attaching a strip of polymer material in which is embedded a strip of carbon fibre voile to the inside of the Earth Box®. The strip of polymer material would typically incorporate a backing sheet, between the strip and the side of the Earth Box®, of reflective foil. The strip would typically be maintained at a temperature above ambient by the application of a low voltage current.



Remove tape after welding